Impacts of Development on Waterways



Watershed Resources Fact Sheet Series

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Land development can drastically alter waterways. Stormwater runoff normally increases with development and often begins a chain of events—flooding, erosion, stream channel alteration, ecological harm and property damage to streamside landowners and roadways. Combined with an increase in manmade pollutants, these changes result in degraded waterways no longer capable of providing good drainage, healthy habitat or the processing of natural pollutants.

Citizens and local officials interested in protecting the community's natural resources and beauty must go beyond standard flood and erosion control practices. The issue of stormwater runoff must be addressed through a multilevel strategy of natural resource-based planning, better site design and best management practices.

Disruption of the Water Cycle

When development occurs, the land alteration can lead to dramatic changes to the *hydrology*, or the way water is transported and stored. Impervious manmade surfaces (asphalt, concrete and rooftops) and compacted earth associated with development block water and little rainfall is absorbed by the soil. Surface runoff increases and groundwater infiltration decreases.

Disrupting the natural water cycle leads to a number of changes:

- * Stormwater flows faster and in greater volume.
- * Floods are more frequent and severe.
- * The peak of stream flow increases significantly during and after storms.
- * Vegetation, wetlands and soil are not available to naturally store water.
- * Groundwater is reduced.
- * Base stream flows decrease significantly during dry weather.

Impacts on Stream Form and Function

RIVERS AND STREAMS connect communities and landscapes into watersheds. This series of fact sheets is designed to help you address the effects of development on our water resources and learn the steps communities can take to reduce those impacts. Communities are affected by the activities of their neighbors—upstream or downstream, uphill or downhill—in a common watershed. Working together, watershed neighbors can find solutions to work for everyone.

Streams must change along with the landscape use. More and faster runoff leads to increased erosion from construction sites and stream banks. Damage then occurs upstream and downstream. Because a stream's shape evolves over time in response to the water and sediment loads that it receives, development-generated runoff and sediment cause significant changes in stream form. To handle the increased flow, streams in urbanized areas tend to become deeper, wider and straighter than wooded streams. Downstream, sediment is deposited and the streambed is raised. When sediment clogs a streambed, the water storage capacity is much less and the chances of flooding increase. Even upstream of development, streams become deeper and wider as they adjust to reach equilibrium with their changed downstream conditions.

These physical changes are readily apparent, but the ecological damage is more difficult to see. Bank erosion and severe flooding destroy valuable streamside, or *riparian*, *habitat*. Less tree cover leads to greater fluctuations in water temperature, making the water warmer in the summer and colder in the winter. Leaves and branches that naturally fall into the water are no longer available to provide food and cover. In addition, loss of tree roots in the riparian zone (which anchor the soil) reduces bank stability and increases erosion. Most importantly, aquatic habitat is lost.



A uniform blanket of eroded sand and silt covers the naturally diverse streambed of pebbles, rock ledges and deep pools.

All of this occurs if streams are left to adjust on their own. As urbanization increases, streams are also altered by diversion, channelization, damming and piping. When disturbances increase, so do the ecological impacts—the endpoint being a biologically sterile stream encased in aboveground channels or underground concrete pipes. In addition, related habitats like ponds and wetlands may be damaged or eliminated through grading and filling.

HABITAT:

The place where a plant or animal naturally lives and grows.

HYDROLOGY:

The science of water properties, distribution and circulation.

RIPARIAN:

Living or located on or near the bank of a waterway.



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Impacts on the Floodplain

Many developments are now built within the floodplains of rivers and streams. By filling these areas, important flood storage capacity is removed. When a floodplain is filled, water cannot spread out. Displaced water must go somewhere; usually flooding is forced into other areas. Building in the floodplain may also constrict the area where water can flow. Water velocity increases causing additional erosion problems and floodwater backs up, flooding upstream areas. See *Fact Sheet #10 Flooding and Floodplain Development* for more information.

Then There's Water Quality

With development comes more intensive land use and a related increase in pollutants, negatively affecting water quality and stream health. *Fact Sheet #2 Nonpoint Source Water Pollution* provides more detail on pollution and its effects.

The Total Picture: A System Changed for the Worse

The hydrologic, physical and ecological changes caused by development can have a dramatic impact on the natural function of our waterways. When increased pollution is added, the combination can be devastating. Studies show a direct relationship between the intensity of development in an area—as indicated by the amount of impervious surfaces—and the degree of degradation of its streams. These studies suggest that aquatic biological systems begin to degrade at impervious levels of only 10 percent. As the percentage of impervious surfaces increases, stream function decreases. As little as 20 percent impervious surface cover in a watershed can render a stream lifeless. The end result is a system changed for the worse.

Healthy water systems provide drainage, aquatic habitat and natural filtering of pollutants. Let's look at those functions in an urbanized watershed without corrective action:

Drainage: Increased runoff leads to flooding. Drainage systems that pipe water off-site often improve that particular locale at the expense of moving flooding (and erosion) problems downstream. Overall system-wide water drainage and storage capacity are impaired.

Habitat: Outright destruction, physical alteration, pollution and wide fluctuations in water conditions (levels, clarity and temperature) all combine to degrade habitat and reduce the diversity and abundance of natural life in the riparian area. In addition, waterway obstructions like bridge abutments, pipes and dams create barriers to migration.

Infrastructure: Those bridges, pipes and dams, in turn, are affected by the changing stream dynamics. With increased peak flow, trees and large items clog pipes and bridge openings, exacerbating flooding. Channel changes eventually undermine roads, bridges and other infrastructure.

Filtering pollutants: Pollutant loads in the urban environment are greater and the effectiveness of natural filtering or processing is decreased. Damage to vegetation, streams and wetlands reduces a watershed's ability to naturally process pollutants. Impervious surfaces prevent infiltration, eliminating natural cleansing in the soil. The greater volume of stormwater runoff pushes water through the system too quickly to allow natural riparian or wetland filtering to occur.